

PROF. THANU PADMANABHAN

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Academic Career: Professor Thanu Padmanabhan is an internationally acclaimed theoretical physicist and cosmologist. Born on 10 March 1957, Padmanabhan did his B.Sc (1977) and M.Sc (1979) from University College, Kerala University, graduating with Gold Medals in both, for topping the University. He published his first research paper in General Relativity at the age of 20 when he was still a B.Sc student. He joined the Tata Institute of Fundamental Research (TIFR) for his PhD in August 1979 and obtained a Faculty position in February 1980 while he was still working towards his PhD, which he obtained in 1983. He held different Faculty positions in TIFR till 1992, when he moved to IUCAA, Pune. He is currently the Distinguished Professor at IUCAA (and was its Dean, Core Academic Programmes for 18 years, during 1997-2015).

He was a Sackler Distinguished Astronomer of the Institute of Astronomy (IoA), Cambridge, UK and a Visiting Faculty at several institutions abroad including Princeton University, California Institute of Technology (Caltech), USA and the IoA, Cambridge. He is currently an adjunct faculty member of IISER (Mohali), IISER (Trivandrum), and Jamia Millia Islamia (Delhi). Earlier, he was an adjunct faculty member of TIFR (Mumbai), IISER (Pune), Raman Research Institute (Bangalore), Harish-Chandra Research Institute (Allahabad).

Research Contributions: Prof. Padmanabhan's original research contributions have made a significant impact on the subjects of gravitation and cosmology.

In recent years (2002 - 2015) he provided a clear interpretation of gravity as an emergent phenomenon and showed that this paradigm extends to a wide class of gravitational theories including — but not limited to — Einstein's theory. Such an interpretation explains why gravity is immune to the bulk cosmological constant, thereby providing a framework for *solving the cosmological constant problem*. The emergent approach to gravity describes the expansion of the universe as an evolution towards holographic equipartition and can explain the numerical value of the cosmological constant in terms of other parameters in high energy physics. These ideas have been well received and e.g., won prizes seven times (in 2002, 2003, 2006, 2008, 2012, 2014 and 2018) in the Gravity Research Foundation Essay Contest, USA including the First Award in 2008.

In the earlier part of his career (1980-2001) he has made important contributions to quantum cosmology, the statistical mechanics of gravitating systems and gravitational clustering in the expanding universe, all of which have been well recognized. (i) Padmanabhan came up (in 1984) with an interpretation of the Planck length as a zero point length for the spacetime and established it with well-chosen thought experiments in 1987. This finds an echo in several quantum gravity models. (ii) He developed the complex path method (in 1998) to study black hole thermodynamics which was a precursor to the 'tunneling paradigm' that became quite popular later on. (iii) He is a recognized authority in the subject of statistical mechanics of gravitating systems and has been invited to lecture twice at the Les Houches Schools (in 2002 and 2008) to a broader community about this subject.

Impact of Research and Citations:

Padmanabhan has a high level of scholarship in many areas of theoretical physics but publishes mainly in Quantum and Classical Gravity, Cosmology and Structure Formation in the Universe.

In his entire career, Padmanabhan has written about 285 papers earning about 15,500 citations. He has one paper with more than 2300 citations, another 28 papers with citations above 100 (of which 1 has nearly

750 citations, 6 have citations in 300-500 range and 10 have citations in the range of 200-300) and 38 papers with citations in the range 50-100. His total number of normalized citations — in which citations of each paper are divided equally among authors — is also quite high, more than 10896 (from ADS). He has a h-index of 58.

During 2002-18, Padmanabhan has published about 132 papers *which alone* have received about 11,177 citations, with an average of 84.7 citations per paper during this period.

Awards and Distinctions: Professor Padmanabhan has received numerous awards and distinctions in India and abroad for his contributions. He is an elected Fellow of all the three Science Academies of India as well as of Third World Academy of Sciences. The national and international awards received by him include, *Padma Shri* (2007), J.C.Bose Fellowship (2008-), Inaugural Infosys Prize in Physical Sciences (2009), Third World Academy of Sciences Prize in Physics (2011), Millennium Medal (2000), Shanti Swarup Bhatnagar Award (1996), INSA Vainu-Bappu Medal (2007), Al-Khwarizmi International Award (2002), Homi Bhabha Fellowship (2003), G.D.Birla Award for Scientific Research, (2003), Miegunah Award of Melbourne University (2004), Goyal Prize in Physical Sciences (2012-13) Birla Science Prize (1991) and INSA Young Scientist Award (1984).

Scientific Mentorship and Leadership: Another feature of Padmanabhan's career — which again sets him apart from many other scientists in his peer group — is his willingness and capability to provide scientific leadership in different ways.

He has supervised the Ph.D. work of 17 students. Of these, 10 have obtained permanent positions in academic institutions in India and many of them are guiding students themselves. In fact, almost all the young ($\lesssim 45$ years) cosmologists working in various institutes/universities in India today have been associated with Padmanabhan and mentored by him in the Ph.D/PDF stage of their career.

He has served in several key committees and has taken a leading role in the development of astronomy in India. A few examples *from the recent years* are the following: (a) The Department of Science and Technology has appointed him as the Convener of the Advisory Group (2008-10) to facilitate India's entry into one of the international collaborations building the next generation Giant Segmented Mirror Telescopes. He has played a *key role in taking this initiative and developing a consensus in the Indian astronomy community* in this task which has now led India into joining the TMT. (b) He served as the Chairman (2006-09) of the Time Allocation Committee of the Giant Meter-wave Radio Telescope of NCRA, and he has introduced many innovative aspects into its working and has been instrumental in streamlining several aspects of GMRT. (c) He was the Chairman (2008-11) of the Indian National Science Academy's National Committee which interfaces with the activities of the International Astronomical Union. In addition to advising the Government on policy issues, this also required him to coordinate the International Year of Astronomy 2009 activities in the country.

Academic Scholarship: The multifaceted contributions of Padmanabhan covers not only research but also several contributions to pedagogical activities. He has authored nine graduate level textbooks out of which six have been published by Cambridge University Press (CUP). These include two advanced level textbooks on cosmology, a three volume treatise on astrophysics, a comprehensive graduate textbook on gravitation and another one on quantum field theory. His book *Structure Formation in the Universe* [1993; CUP] has been recognized as a classic in the field and his three-volume treatise on *Theoretical Astrophysics* [2000-2002; CUP] has been widely acclaimed as a magnificent achievement. These books are used extensively in several universities and institutions all over the world as graduate level textbooks.

Science Popularization: Padmanabhan is strongly committed to the responsibilities of scientists towards the society and has been actively working on popularization of science through his numerous articles (> 100), lectures (> 300), books and other public outreach programmes. His popular science book *After the first three minutes* [2000; CUP] has been translated into Portuguese, Chinese and Polish. Another work of his *The story of physics*, published by Vigyan Prasar, Delhi (year) has been translated into several Indian regional languages and made available at schools at an affordable cost.